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SOYBEAN PRODUCTION IN 1973 AND BEYOND

Jerry A. Sharples, W. H. Brown,
Rodney Paul, and J. B. Penn

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Summary

This analysis indicates that a production goal of 1.4 billion bushels of soybeans and 5.0 billion bushels of corn in 1973 can be attained through appropriate specification of the 1973 feed grain program. Of the several alternatives analyzed the one which gave the most promising results provided for: (1) required feed grain setaside of 20 percent, (2) voluntary setaside of 35 percent at a payment rate of $.60 per bushel for corn and similar payments for grain sorghum and barley under option A, and (3) a payment of $.20 per bushel for corn and $.18 per bushel for grain sorghum for reducing the 1973 corn and sorghum acreage below the 1971 acreage under option B. Under the latter option any uncontrolled crop could be planted on the acreage removed from corn or sorghum. With this set of specifications, labeled "20 percent revised" in this report, production within 1 percent of the above targets could be achieved.

The above production goals would probably be met, with interagency committee yield projections for 1973, if farmers planted 50.6 million acres of soybeans and 65.3 million acres of corn. This is a 4.2 million acre increase in soybeans and a 1.5 million acre decrease in corn acreage. The soybean increase would be the largest on record, following a substantial increase in planted acres in 1972.

The outlook for soybean production in 1973, assuming no change in the cotton or feed grain program, was examined by major soybean producing regions--Corn Belt, Delta States and Southeast. In general, soybean experts expected little change in the Delta, constant or a slightly decreased acreage of

soybeans in the Corn Belt, and a slight increase in the Southeast. Overall, no change from 1972. Thus, opinion and history suggest that the desired increase in soybean acreage is unlikely to occur unless a major inducement to shift from corn to soybeans is provided.

Other analyses indicate any substantial increase in soybean acreage in 1973 will have to be stimulated by the commodity programs--primarily the feed grain programs. The program will have to be especially designed to not only increase soybeans, but to give the desired acreage of corn. One alternative examined was the 1972 feed grain program with expanded signup in Alternative B. Results indicated that even with an unexpectedly large signup under Alternative B, the soybean goal might not be reached, corn would be reduced too much, too much land would be set aside and the program cost would be high.

Another approach--one which was not evaluated in detail--would be to use the "20%-Revised" program without Alternative A. The main drawback from this approach is that total setaside acreage would be substantially reduced and a corn crop of the 1971 magnitude might result. For example, the APAT results for 1973 had 7 million acres of voluntary setaside under alternative A for corn, and 3 million acres for grain sorghum. If no alternative A were offered, most of this acreage would go into feed grain production.

The general outlook for soybeans by regions was examined in some detail. In the Corn Belt about 750,000 acres will shift from close-grown crops (wheat, oats, hay) to row crops (soybeans, corn, grain sorghum) in 1973. Also, for each acre decrease in setaside acres from 1972, there will be about a 2/3 acre increase in row crops. These estimates are based on stable historical trends.

The relatively high price of corn, however, will induce farmers to put the increased acres into corn in 1973. But weather at corn planting time always remains as an important (and unpredictable) variable affecting corn and soybeans in the Corn Belt.

In the Delta States soybean acreage has not increased since 1969. Removal of total allotments in 1971 and higher price expectations in 1972 resulted in increased cotton acreage at the expense of soybeans. For many cotton-soybean growers, 25 cents a pound for cotton appears to be a critical price. With higher cotton prices there isn't much chance for an increased soybean acreage by these producers. With lower cotton prices some land marginal to cotton will be shifted to soybeans. We estimate that about 12 percent of the cropland in the Mississippi Delta is of a soil type which shifts between soybeans and cotton depending on the relative prices of the two crops.

In the Southeast farmers have been switching from corn, cotton and other crops to soybeans for many years. This trend in adoption of soybeans should continue in 1973. Many management problems with soybeans (weeds, storage space, diseases, etc.) have slowed the increase in soybean acreage in the Southeast.

The report also discusses other factors that will affect the longer-run outlook for soybean production. These include the weed problem and chemical weed control, the prospects for variety improvements, doublecropping in the South, land clearing, complementarity between soybeans and corn, risk spreading, weather at planting and harvesting, and the impact of farm type on soybean acres.

SOYBEAN PRODUCTION IN 1973 AND BEYOND

by

Jerry A. Sharples, W. H. Brown, Rodney Paul, and J. B. Penn[1]

Perspective

The analysis reported here evaluates the possibility of attaining in 1973 production goals of 1.4 billion bushels of soybeans and 5.0 billion bushels of corn and assesses implications of achieving such production. The report focuses on production--not on demand. The report also focuses on soybeans although relationships among soybeans, corn, and other crops are examined. First, the production goals are placed in historical perspective, and the acreages implied by the goals are estimated. Second, price and nonprice factors affecting soybean production and their short-run impact on the expansion of soybean production are examined by major production regions. Third, changes in farm commodity programs are evaluated relative to the corn and soybean production targets.

Acreages Implied by Production Goals

Production is the product of yield and acres. In the short-run, aggregate yield is very difficult to change. Factors beyond the control of farmers or policymakers will have a major influence on any deviation in next year's yield from a trend projection. Acres planted and harvested, however, can be significantly changed in the short-run by farmers' and policymakers' actions. Thus in the remainder of this report, acres planted will be stressed

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[1] Agricultural economists FPED, ERS. Valuable insights into soybean production were provided by Fred T. Cooke, Jr., FPED, ERS, and many Experiment Station and Extension Service people throughout the Midwest and South.

with but slight reference to yields. But as table 1 shows, deviations in yields from the expected can have a large impact on production. For example, in 1973 there is a 90% chance that the national soybean yield will be between 25.6 and 30.4 bushels per acre. The production goal of 1.4 billion bushels could require as few as 46.7 or as many as 55.9 million acres, given the 90% confidence interval on yield. In 1972, 46.4 million acres were planted, so an increase of from 0.3 million to 9.5 million acres might be needed depending on the yield. However, the most likely acreage needed in 1973 to reach the production goal is 50.6 million acres.

Similar analysis is made for corn and is shown in table 1.

In order to compare the 1973 acreage goal with historical trends, soybean and corn planted acreages are shown in figures 1 and 2. Cotton is also shown (figure 3) to point out the large increase in 1972 acreage. As shown in these figures and in table 2, the change in corn acreage necessary to reach the production goal in 1973 is modest relative to historical changes. The increase in soybean acres, however, would need to be the largest in history--following a year that already had a substantial increase. Thus if history is a good indicator, it is highly unlikely that the soybean goal can be met without a major inducement to switch from other crops.

Price Perspective

Conceptually, the situation treated here may be framed in the simplified context below.

The reference to yields. [illegible]

s from the expected to have a [illegible] impact on production. For example

[illegible]

an 30 [illegible] The production [illegible] 1.1 [illegible]

[illegible]

[illegible] from 9.2 [illegible] to 9.5 [illegible]

[illegible] production [illegible] 50.5 million acres

[illegible]

[illegible] average [illegible]

[illegible]

[illegible] 31 to [illegible] increase in 1972 [illegible]

[illegible] figures [illegible] in table 2, [illegible]

the production [illegible] 1973 [illegible] to 6½ [illegible]

the soybean [illegible] however, would [illegible]

[illegible] years that already had a [illegible] increase. [illegible]

a [illegible] soybeans [illegible]

for a [illegible] other crops

Consequently, the [illegible]

Table 1. U.S. yield projections and implied harvested and planted acreage necessary for attaining soybean and corn production goals, U.S.

Crop and yield limit	Projected 1973 yields per harvested acre		Acreage harvested for grain		Planted acreage	
	Prediction interval					
	90%	60%	90%	60%	90%	60%
	bushels		million acres			
SOYBEANS						
At upper yield limit	30.4	29.5	46.1	47.5	46.7	48.2
Mean	28.1	28.1	49.8	49.8	50.6	50.6
At lower yield limit	25.6	26.5	54.7	52.8	55.9	53.8
CORN						
At upper yield limit	100.2	96.8	49.9	51.6	60.3	62.0
Mean	91.0	91.0	54.9	54.9	65.3	65.3
At lower yield limit	81.9	85.3	61.1	58.6	71.5	69.0

* Prediction intervals were calculated for a linear time trend regression estimate of 1973 yields for national yield data since 1954. The mean corn and soybean yields are official ERS projections for 1973. The upper and lower limits to the prediction interval are interpreted as follows: based on past performance, there is a 90% probability that the actual 1973 yield of corn will fall between 81.9 and 100.2 bushels per acre. A 60% prediction interval has narrower yield limits. Harvested acres were obtained by dividing the production goals by the projected yield. Planted acres were estimated using the historical functional relationship between planted acres and acres harvested for grain.

Table 2. Corn and soybean acreage targets in perspective, U.S.

Item	Unit	Corn	Soybeans
Planted acres:			
1971*	1,000 acres	74,097	43,176
1972*	1,000 acres	66,846	46,423
1973**	1,000 acres	65,300	50,600
Change in planted acres:			
1972-1971	1,000 acres	-7,251	3,247
1973-1972	1,000 acres	-1,546	4,177
1973-1971	1,000 acres	-8,797	7,424
Largest previous change in one year since 1950:			
Year	---	1961	1965
Change	1,000 acres	-15,506	3,506
Largest previous change over two years since 1950:			
Years	---	1960-1961	1964-1965
Change	1,000 acres	-16,823	5,702

*Source: SRS, USDA, Crop Production, July 12, 1972.

**Estimated acreages using 1973 ERS yield projections and production goals.

Figure 1. Soybean Production and Planted Acres, U.S.

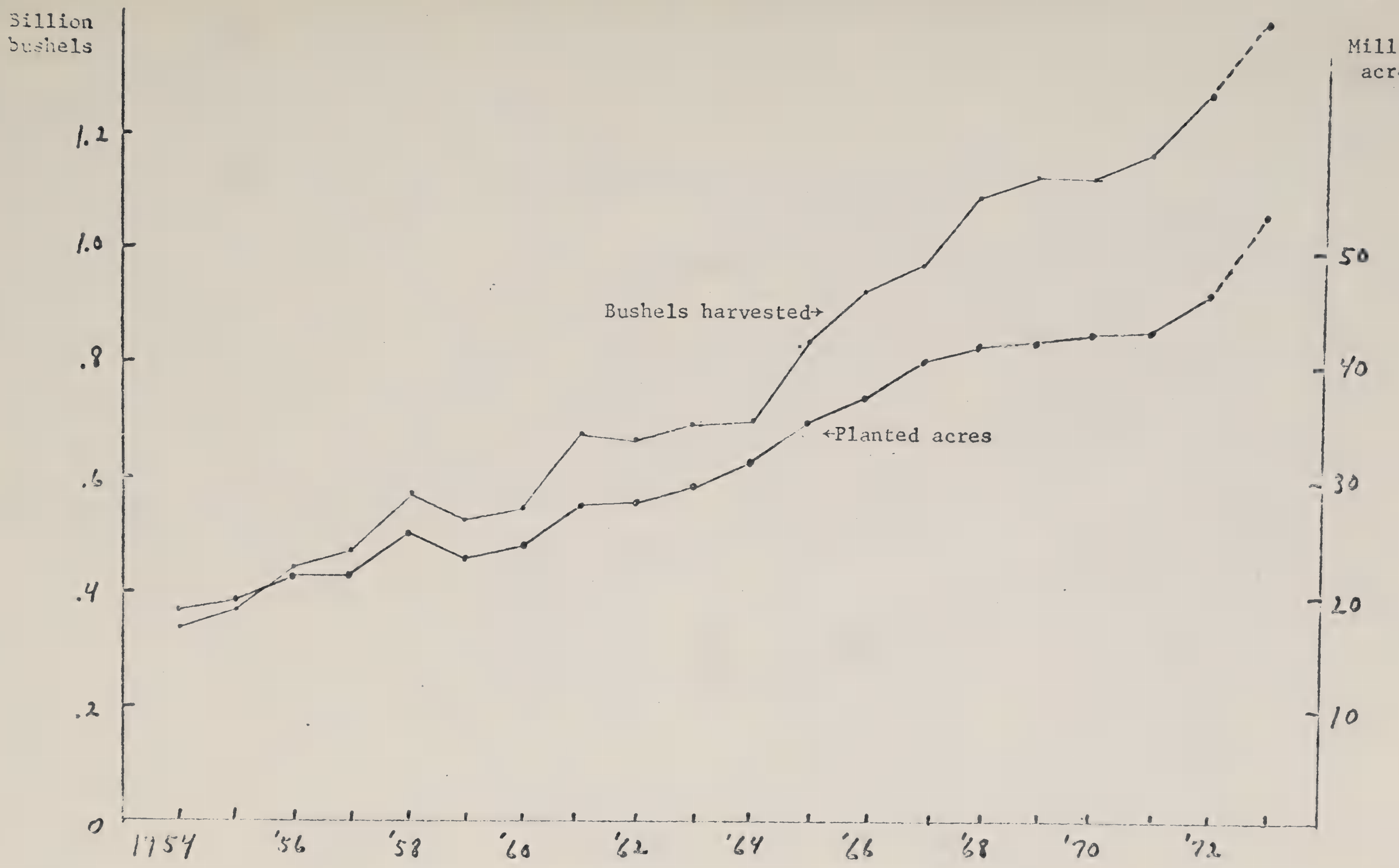


Figure 2. Corn Production and Planted Acreage, U.S.

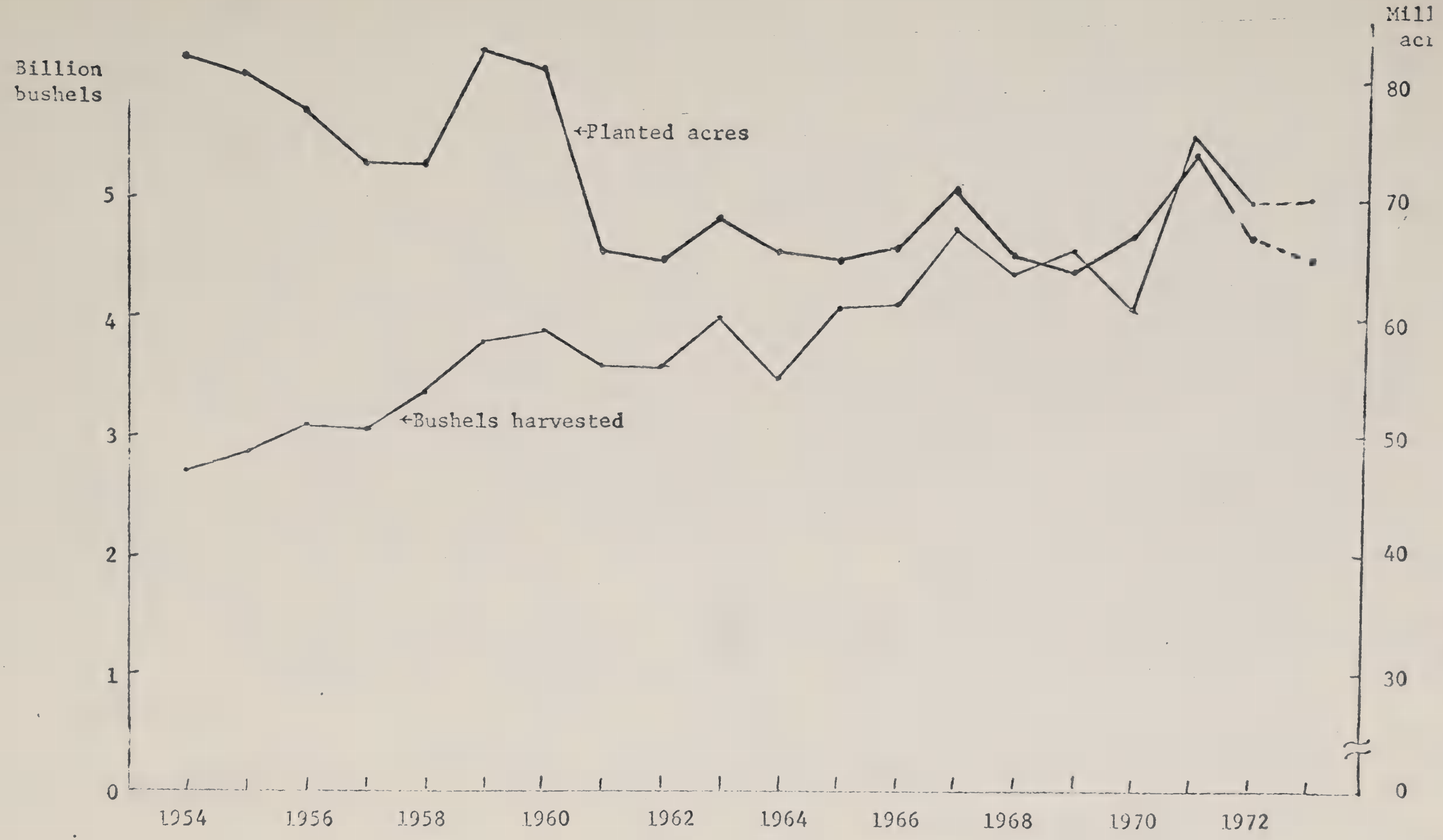
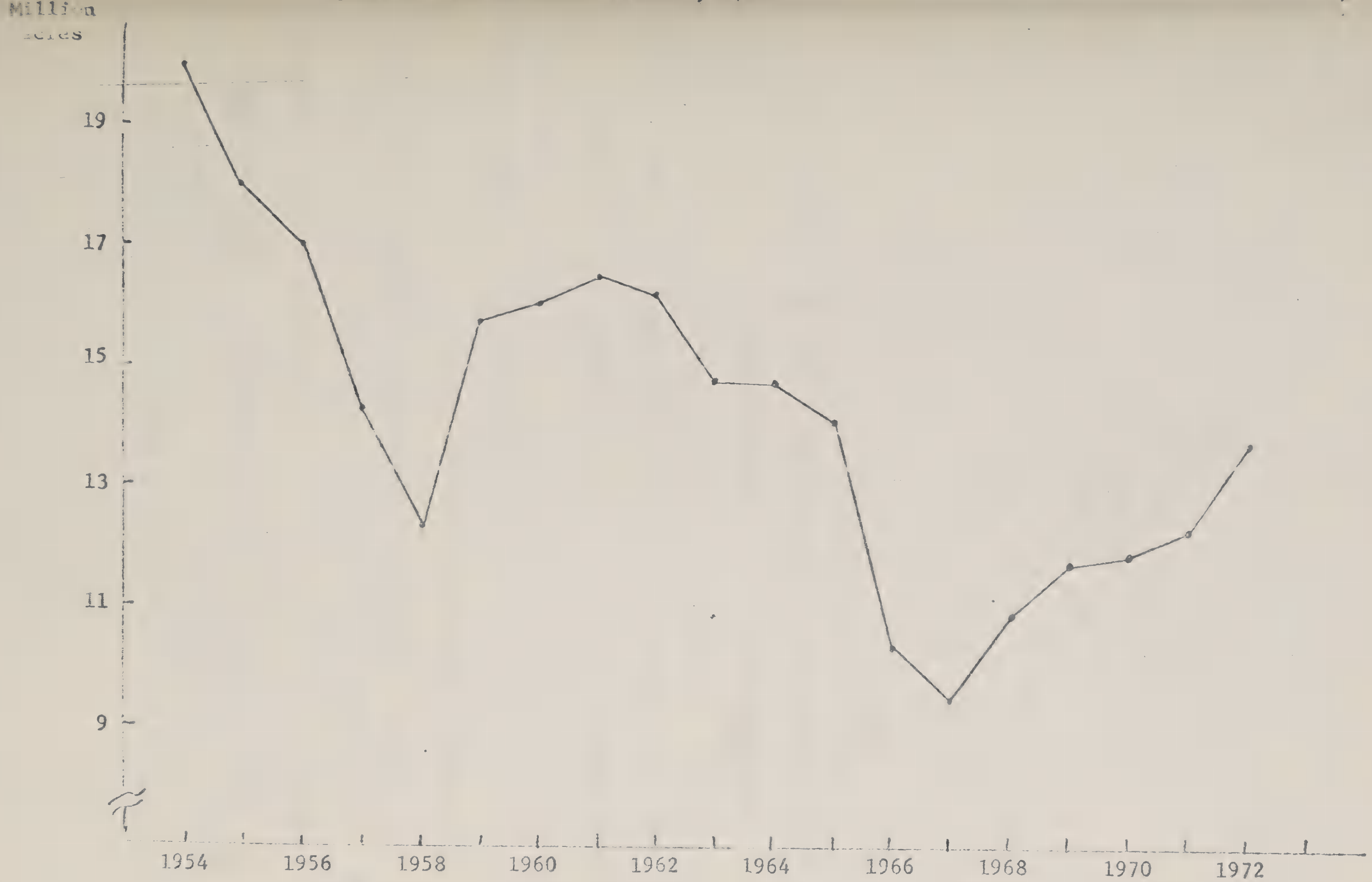


Figure 3. Cotton Acres Planted, U.S.



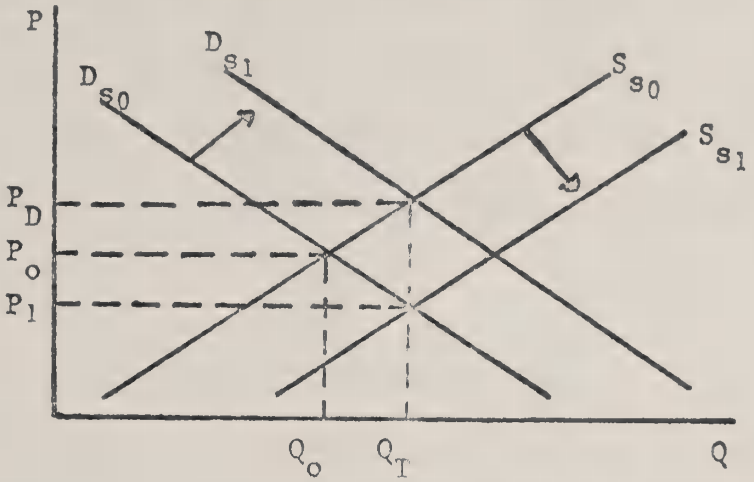


Figure 4.

In figure 4, P_o and Q_o may be viewed as the current (1972) price and quantity. Q_T is the target quantity desired by policy makers. Achievement of Q_T may be accomplished in either of two ways, or a combination of the two. First, the target could be realized if demand should shift to D_{s1} so that more could be produced at a higher price--a price much higher than currently prevails, i.e., P_D. Second, the supply curve could be shifted to the right with the help of Government farm program inducements or some technological change. In 1973 the most likely outcome is for some shifting to occur in both supply and demand, so that the market price will fall somewhere between P_D and P_1. If the target production, Q_T, is reached in 1973 the increase is of the magnitude that would probably lead to a market price between P_o and P_1, i.e., somewhat below the average 1972 price.

A very rough estimate of the price implications of the target quantities assuming no shift in demand is obtained from Matthews, Womack and

Figure

Figure 4, P_d and Q_d [illegible] viewed as [illegible] current (1972) price [illegible] line. Q_t is the target quantity determined by policy makers. Achievement may be accomplished in either of two ways, or a combination of the [illegible] the target could be realized if [illegible] should shift [illegible] could be produced at a higher price--a price much higher than current levels, i.e., P_t. Second, the supply curve could be shifted to the [illegible] the help of Government farm program [illegible] or new technology changes. In 1973 [illegible] most likely outcome is for some shifting to occur with supply and demand so that the market price will [illegible] somewhere [illegible] and P_t. If the target production, Q_t, is reached in 1975 the in- [illegible] of [illegible] that would probably [illegible] to [illegible] below the average 1972 price.

[illegible] estimates [illegible] price implications of the target quanti- [illegible] demand [illegible] obtained from Matthews, [illegible] and

Hoffman.[2] They estimate a 100 million bushel increase in supply of soybeans relative to demand to have a 60-cent impact on price. Thus, a 1.4 billion bushel crop is a 123, (1,400 - 1,277), million bushel increase. With an expected increase of some 6 million bushels in demand this implies a price reduction of about 35 cents from 1972 or a price of about $2.90 per bushel received by farmers.

SOYBEAN POTENTIAL BY REGIONS

In order to evaluate the possibilities and probabilities of achieving the U.S. soybean and corn production targets, it is first necessary to examine the factors affecting recent trends in acreage and to determine which factors might permit or inhibit a major soybean expansion in 1973. This can best be done by geographical regions.

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[2] Matthews, J. L., Abner W. Womack and Robert G. Hoffman, "Formulation of Market Forecasts for the U.S. Soybean Economy with an Econometric Model," The Fats and Oils Situation, FOS-260, November 1971.

Soybean Production in the North Central Region[3/]

From 1960 to 1972 planted acres of soybeans in the United States increased 22.0 million acres. Over half of the increase (11.9 million acres) occurred in the North Central Region. Two major reasons for the increase in production were: (a) the feed grain program, and (b) gradual shift in land use away from hay and close grown grains toward rowcrops.

The Feed Grain Program

The feed grain program played a major role in the expansion of soybeans in the North Central States during the 1960's. Farmers who participated generally planted corn up to the acreage limit allowed for their farm, diverted the required acres, and planted the remainder of their good land to soybeans. For these farmers, corn did not compete with soybeans on the land in excess of feed grain base. For the nonparticipant, however, corn competed directly with soybeans for the land suitable for row crops. Examination of nonparticipant farms during the 1960's indicates that soybeans was not a strong competitor with corn. In the heart of the Corn Belt, farm records for 1970 indicated that the corn-to-soybean ratio of planted acres was in excess of 3:1 on nonparticipants' farms, but less than 1:1 on participants' farms. The nonparticipant, relying on market prices, raised relatively fewer soybeans. The implication is that with the elimination of corn acreage controls (as was allowed by the Agricultural Act of 1970), participants would make planting decisions similar to their nonparticipating neighbors of the 1960's--increase corn

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[3/] The North Central Region consists of Indiana, Illinois, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin.

and decrease soybeans. Of course, this assumes that farmers' relative price expectations for corn and soybeans did not change.

Did this in fact happen in 1971 and 1972? Did farmers reduce soybeans? In 1971 diversion was decreased by 6.6 million acres from 1970. And in spite of the threat of severe corn blight, farmers in the North Central Region increased their acreage planted to corn by 5 million, but did not change their soybean acreage. In 1972 a combination of an improved relative price outlook for soybeans, bad spring planting weather for corn and alternative B of the feed grain program all worked to stimulate a 2.6 million acre increase in soybeans while corn decreased 4.9 million acres. The evidence from 1971 strongly supports the hypothesis that given historical corn-soybean price relationships, soybeans will decrease if not artificially boosted by farm programs. The 1972 situation is more difficult to interpret but evidence, in general, seems to support the hypothesis. Farmers will grow more corn than soybeans at historical price relatives if they are not induced to do otherwise by farm programs.

Shift in Land Use

During the 1960's substantial acreage shifted out of hay, oats and wheat as farmers made major changes in their traditional farming practices. Indications are, however, that this shift is about over. The high quality land that is suitable for rowcrops appears to now be in rowcrops, or set-aside. The remaining hay and oat acreage is primarily on poorer land. Due to the acreage controls on corn during the 1960's, most of the land use shift from the less intensive to the more intensive crops benefited soybean production. Profits from soybeans were considerably higher than for oats, wheat or hay on most farms.

The relationships among the shift in cropland use, the farm programs, and the acreage planted to major crops were quantified for the North Central Region using multiple regression techniques. The results are shown in the three following equations and in figure 5. The equations are:

(1) $Y_I = 89{,}119 - 26{,}580(.898)^{X_1} - 0.674X_2$ $R^2 = .97$

(2) $Y_E = 21{,}135 + 26{,}538(.941)^{X_1} - 0.081X_2$ $R^2 = .95$

(3) $Y_S = 31{,}285 - 14{,}659(.906)^{X_1} - 0.023X_2$ $R^2 = .94$

where

Y_I(intensive crops) = planted acres of corn, soybeans and grain sorghum in 1,000-acre units,

Y_E(extensive crops) = planted acres of oats and wheat plus harvested acres of hay in 1,000-acre units,

Y_S(soybeans) = planted acres of soybeans in 1,000-acre units,

X_1 = (time) with 1961 = 1, 1962 = 2, ..., 1971 = 11,

X_2(diversion) = feed grain and wheat diversion and set-aside in 1,000-acre units.

In all 3 equations, the dependent variable is a function of time and diversion. Intensive land use (1) is expected to increase at a decreasing rate over time, but additional year-to-year fluctuation is expected due to the level of wheat and feed grain set-aside or diversion acreage. For a given point in time, the acreage of intensive crops is expected to go down as diversion acreage or set-aside goes up. Extensive land use (2) is expected to decrease at a decreasing rate over time, and decrease with increases in diversion or set-aside. Soybeans (3) is expected to have the same nature of response to X_1 and X_2 as intensive land use.

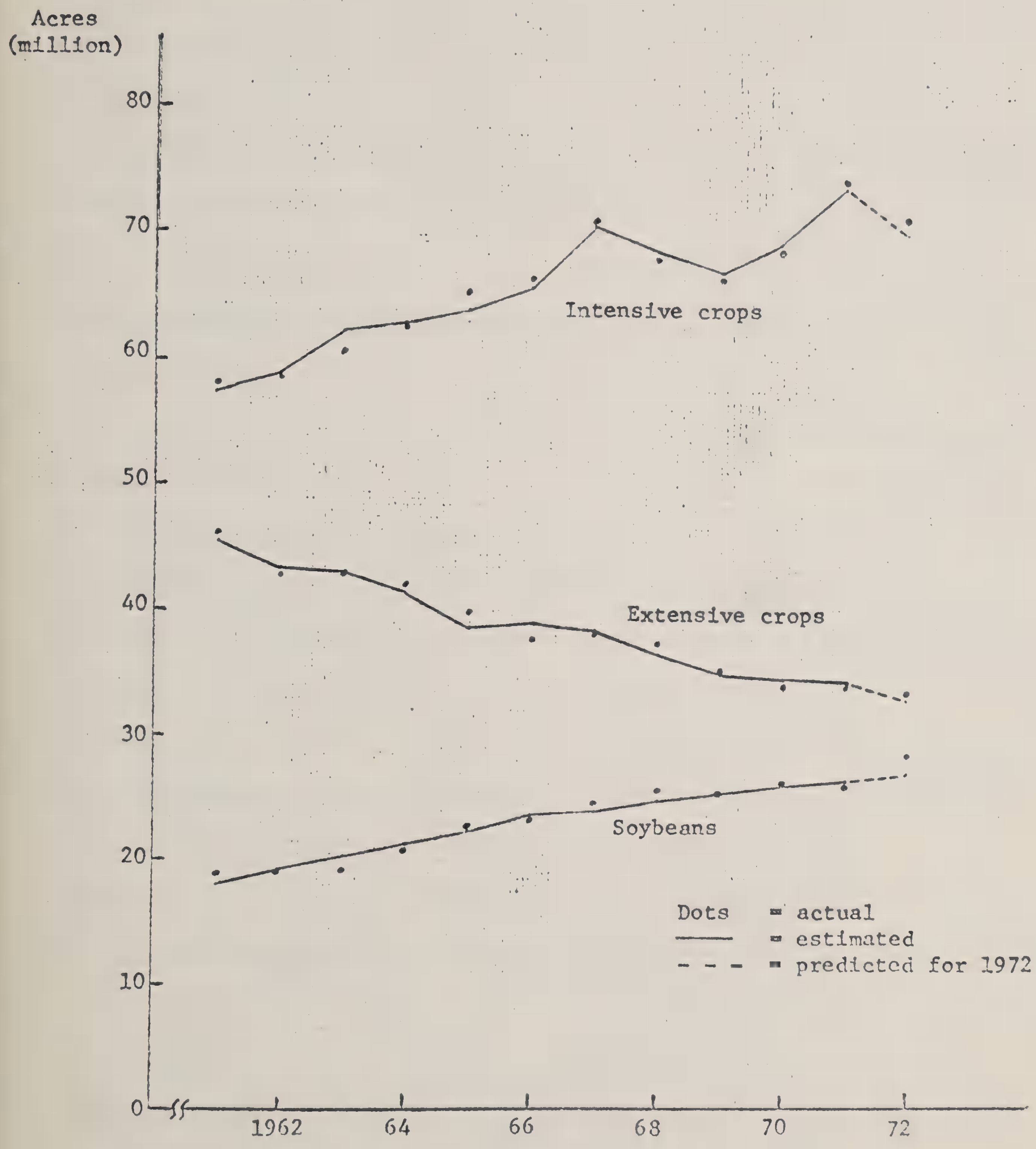

Figure 5. Land use trends in the North Central Region, actual and estimated from 1961 to 1971, predicted for 1972.

In all three equations, the dependent variable is expressed as an asymptotic function of time. This form gives a better statistical fit and is more plausible theoretically than a linear or quadratic form.

A two-step estimation procedure was used. First, the dependent variable was regressed against time using the form:

$$(4) \quad Y_I = B_0 + B_1 r^{X_1}$$

Then the dependent variable was regressed against $\tilde{Y}$ and X_2 using the form:

$$Y_I = B_2 + B_3 \tilde{Y} + B_4 X_2$$

where the $\tilde{Y}$ were the estimated values obtained from (4). The same two-step procedure was used for Y_E and Y_S.

The size of the R^2 values and figure 5 indicate that the equations accurately fit the land use shifts from 1961 to 1971. Intensive land use is most accurately estimated and soybean acreage is least accurately estimated.

Examination of the diversion variable, X_2, indicates that it was a major factor in estimating intensive land use, but it was of little value in estimating soybean acreage or extensive land use. Equation (1) indicates that after accounting for trend, there is a decrease of 2/3 acre of intensive crops for each 1 acre increase in diversion. The total impact of an increase in diversion was on the corn and grain sorghum portions of the intensive crops.

These equations were estimated with data primarily from the years of the old farm programs. Are they relevant under conditions of greater freedom for farmers to choose what to grow as provided by the Agricultural Act of 1970? The shift in land use from extensive crops to intensive crops should continue at the projected rates unaided or unimpeded by the new legislation.

The impact of variations in set-aside acreage should be about the same as during the 1960's. But the acreage of individual intensive crops (corn, grain sorghum, and soybeans) could be greatly affected by the structure of the annual programs under the Agricultural Act of 1970. For example, 1972 predictions of Y_I, Y_E and Y_S were made using the estimating equations. These estimates were then compared with July 1 estimates of 1972 planted acres, figure 5. In all three cases the direction of change was correctly predicted and the magnitude of error was small for both intensive crops (2%) and extensive crops (2%). But response to alternative B of the 1972 feed grain program was several million more acres of soybeans than was predicted by equation (3).

Ignoring the impact of the changes in diversion, about 750,000 acres could shift from extensive crops to intensive crops from 1972 to 1973. That compares with a shift of about 2 million acres from 1961 to 1962. If set-aside is decreased, the land in intensive crops could increase by more than 750,000 acres in the North Central States. Thus the model can give a fairly reliable prediction of the acreage shifted to intensive crops in 1973. What this model does not show is how that increase will be divided among corn, grain sorghum and soybeans. To answer this question, other questions need to be examined. Who are the soybean producers? What influences them to change their soybean acreage? These questions are examined below.

A Profile of Soybean Producers in the North Central Region

Census data for 1969 indicate that only 40 percent of all farms in the North Central States grow soybeans. This percentage has remained constant since at least 1964, but the acreage per farm has increased substantially.

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the 1960's. But the success of [illegible]

figures, are [illegible]

programs [illegible]

ones of Y_1, Y_2 and Y_3 [illegible] equations [illegible]

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In all these [illegible]

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(27). Subsequently [illegible]

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Who are the soybean producers? What influences them to [illegible]

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[illegible] only [illegible] percent of all farms in the

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The bulk of the soybeans are grown on cash grain farms (61%) with much of the remainder (27%) grown on livestock farms. Nearly a third of the cropland on cash grain farms is planted to soybeans. On the other hand, the two other major types of farms, livestock and dairy, have only 13 and 4 percent, respectively, of their cropland in soybeans. Livestock and dairy farms put most of their good land into corn and other feed crops.

The acreage of soybeans per farm tends to be small in the North Central States, compared with other soybean states, but the large total acreage is spread over a very large number of farms. In Illinois, for example, over 6 million acres of soybeans were grown in 1969 but only 2 percent of the acreage was on farms with 500 or more acres of soybeans (table 4). A considerably larger proportion of soybeans are raised on large soybean farms in states like Arkansas, Tennessee or South Carolina.

Soybeans can be increased by (a) increasing the proportion of farms raising soybeans, and (b) increasing the acreage per farm raising soybeans. In recent years (b) has occurred but (a) has not. Over the next few years a structural change that could increase soybean acreage would be a shift in cropland to cash grain farms from the other types. This did not occur, however, from 1964 to 1969.

Finally, it should be noted that while government feed grain programs affecting cash grain farms are the most effective in influencing soybean acreages, livestock farms also account for a sizeable share of cropland devoted to soybeans and factors affecting livestock production may also influence soybean production.

Table 3. Proportion of farms raising soybeans and distribution of soybeans and total cropland acreage by type of farm, North Central Region, 1969.[1]

Type of farm	No. of farms	Farms raising soybeans		Soybean acreage harvested			Percent of cropland in soybeans
		Number	Percent	Total	Percent of all soybeans	Acres per farm raising	
	(000)	(000)		(000)			
Commercial							
Cash grain	191	154	80	14,217	61	92	30
Livestock	257	112	43	6,221	27	56	13
Dairy	142	23	16	871	4	38	4
Other	64	17	27	1,242	5	71	12
TOTAL	654	306	47	22,551	97	74	17
Noncommercial	247	52	21	808	3	15	7
TOTAL ALL FARMS	901	358	40	23,359	100	65	16

[1] North Central Region consists of Indiana, Illinois, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin.

Source: 1969 Census of Agriculture.

Table 4. Distribution of harvested soybean acres by numbers of acres harvested, commercial farms, selected states, 1969.

Item	Unit	Illinois	Tennessee	S. Carolina	Arkansas
Under 100 acres harvested	percent	34	25	28	6
100-499 acres harvested	percent	64	50	52	43
500 or more acres harvested	percent	2	25	20	51
TOTAL	percent	100	100	100	100
Soybean acres	1,000 acres	6,294	918	791	4,176

The Relative Profits: Corn vs. Soybeans

At current prices there is little question that soybean returns are competitive with corn. The crucial question is, "do farmers view the expected 1973 return from soybeans in the same light as they view the expected 1973 return from corn?"

There is evidence that they do not. Recent FPED research has attemped to explain why.[4] Producers view the loan rate as a floor on market prices. For corn the loan rate is relatively close to the market price whereas for soybeans the loan rate is currently about $1.00 below the market price. Producers are suspicious that since soybeans are at their highest level in recent history, there is more of a chance that the price will fall rather than rise. Taking the spread between the loan rate and the current price level into account, farmers' price expectations for corn would be only slightly below current corn prices, but their price expectations for soybeans would be substantially below current soybean prices.

The relative profitability of corn and soybeans at recent prices and at the floor prices for both commodities are shown in table 5. These data indicate that at recent corn and soybean prices, soybeans equal or exceed corn in returns over variable cost. But, when the floor price of each commodity is used, returns from corn are consistently and significantly higher than from soybeans. In the aggregate, farmers' profit expectations fall somewhere in between, where the returns per acre would be very close--close enough so that nonprofit factors would play a major role in a farmer's decision on how much corn and soybeans to plant.

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[4] Hinman, H. R. and M. H. Erickson, "Using Simulation to Calculate Expected Returns from Corn and Soybeans," unpublished manuscript presented at the American Agricultural Economics Association Annual Meeting, Gainesville, Florida, August 21-23, 1972.

Table 5. Soybean and Corn Profitability Under Various Expected Prices.

Area	Variable Cost[*] (Dollar)	Yield[*] (Bushel)	Recent Price (Dollar)	Return (Dollar)	Loan Price (Dollar)	Return (Dollar)
Soybeans						
Southern Minnesota	18.75	22.7	3.25	55.02	2.25	32.32
Central Iowa	21.55	31.5	3.25	80.82	2.25	49.33
Northwestern Missouri	22.42	28.4	3.25	69.88	2.25	41.48
Northern Illinois	23.69	30.3	3.25	74.78	2.25	44.49
Northern Indiana	23.79	26.7	3.25	62.98	2.25	36.29
Northwestern Ohio	21.11	25.1	3.25	60.47	2.25	35.37
Corn						
Southern Minnesota	38.35	81.4	1.15	55.26	1.05	47.12
Central Iowa	47.61	103.0	1.15	70.84	1.05	60.54
Northwestern Missouri	36.75	80.0	1.15	55.25	1.05	47.25
Northern Illinois	48.84	104.0	1.15	70.76	1.05	60.36
Northern Indiana	44.50	96.0	1.15	65.90	1.05	56.30
Northwestern Ohio	42.93	89.0	1.15	59.42	1.05	50.52

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[*] Costs and yields are taken from "Selected U.S. Crop Budgets, Yields and Inputs and Variable Costs, Volume 11, North Central Region," ERS 458, April 1971.

Nonprice Factors

This discussion of identification and importance of nonprice factors affecting soybeans in the near future draws upon an opinion poll conducted by the Soybean Task Force.[5] Experts in the production of soybeans were solicited for their opinions on causes of past increases in soybean acreages and factors affecting continued expansion.

The most frequently mentioned reason why farmers in the Corn Belt grow soybeans was that they fit well in the rotation, i.e., soybeans are not highly competitive for time and labor at planting or harvest. Corn yields are more responsive to prompt planting in the Spring (table 6). Thus, farmers will plant corn first. If Spring weather is good relatively more corn will be planted. But if unfavorable Spring weather delays corn planting, farmers will plant more soybeans. In the Fall, the weather can affect the harvesting loss of soybeans more than corn. Timely harvesting of soybeans is critical, but usually precedes corn harvest.

Most farmers are reluctant to plant all their good cropland to corn and indeed may not have the labor and machinery at planting or harvest to do so. A corn-soybean or corn-corn-soybean rotation is perhaps an ideal rotation both in terms of timeliness and economics for farmers. Soybeans following corn benefit from the residual fertility left by corn. Soybeans following soybeans do not yield as well and therefore result in reduced profits from yield reduction, increased fertilizer cost and additional herbicide cost.

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[5] "Soybeans: Potential and Problems; A Report on an Expert Opinion Poll," unpublished report by Soybean Task Force, FPED, ERS.

Table 6. Example of impact of planting period on corn and soybean yields, Indiana.

Planting date	Corn	Soybeans
	— bushels per acre —	
April 26 - May 2	136	--
May 3 - May 9	136	47
May 10 - May 16	129	44
May 17 - May 23	123	42
May 24 - May 30	110	41
May 31 - June 6	98	40

Another nonprice factor frequently mentioned was risk spreading. The mention of risk as a reason has at least two aspects: spreading risk of crop failure and risk of price variability. Soybeans tend to withstand drought stress better than corn and it is unlikely that both corn and soybeans would suffer from declining prices at the same time.

Factors mentioned that might inhibit continued expansion in soybean acreage were weed control, farmers' psychological preference for corn production, erosion, and lack of knowledge about the technology associated with soybean production. Weed control is a major problem in soybean production. It was estimated that weeds may reduce yields as much as 50 percent. The aggregate yield reduction was estimated to be in the 12 to 20 percent range. Chemical weed control is still not completely reliable and is relatively expensive. In comparison to corn, soybeans are poor weed competitors. Soybeans following soybeans in rotation often result in very weedy fields unless large quantities of expensive chemicals are used.

[illegible] are ways of control, between [illegible] pesticidal [illegible] [illegible]

[illegible] ptors, and lack of knowledge about the behavior [illegible]

[illegible] may cause [illegible]

reduction [illegible] the 12 [illegible]

control is still not complete [illegible] relatively [illegible]

[illegible] to [illegible]

attraction [illegible] can result [illegible] very [illegible] unless large [illegible]

Because of the several management problems associated with soybean production, it was hypothesized that soybean yield would fluctuate more than corn yield over time. To test this hypothesis historical yield data were examined in 70 counties in Ohio, Indiana, Illinois and Iowa. A time trend was estimated for both corn and soybean yield data for each county from 1963 to 1971. Relative variation around the regression line was used as a measure of risk. The standard error of estimate for each county was divided by the average yield to get the relative deviation for each crop. In Iowa and Ohio, soybean yields were more variable than corn yields, but in the other two states the opposite was true (table 7). Corn blight in 1970, especially in Illinois and Indiana, contributed to the variability of corn yields. However, examination of the data indicates that the results would not be greatly changed by the elimination of the year affected by the blight. In general, the evidence suggests that soybean yields are not more variable than corn yields--historically soybean production apparently was not more risky in the heart of the Corn Belt.

Producer preference for corn probably is associated with experience with corn production. Soybeans are a relatively new crop in some areas and have production problems of a different nature than corn. Soybean production technology for high yields is not widely known or used. Many farmers do not use available information and many complain that extension personnel are not explicit about approved practices in soybean production. Since soybeans is a second crop to corn on many farms, it apparently does not receive the same quality of management as does corn.

Table 7. Relative variability of corn and soybean yields per harvested acre.

State	Percent variation[1]	
	Soybeans	Corn
Illinois	8.6	13.9
Indiana	11.4	14.5
Iowa	10.8	9.7
Ohio	12.2	9.7
Average	10.8	12.0

[1] Average of the standard error of estimate for each sample county divided by the mean county yield.

In the context of the corn-soybean acreage shift question, it has been suggested that one factor which might inhibit an acreage shift to soybeans in the North Central States is the use of Atrazine on corn acreage. It has been thought that Atrazine possibly has a residual or carryover effect to the following year which could damage soybeans planted on treated land. Both the extent of Atrazine usage in the major corn producing states and the seriousness of possible residual effects were investigated and the information obtained is reported below.

Unpublished data from FPED, ERS were obtained for 1971 which indicate the magnitude of Atrazine usage (table 8). Forty five percent of the acreage harvested for grain was treated with Atrazine and Atrazine mixtures in 1971. About the same percentage was treated in the five Corn Belt States. While no information on rotation was available, it appears that should serious residual effects be present, Atrazine use could be an important constraint to obtaining large acreage shifts.

Table 8. Herbicide Use on Corn in Selected States.[1]

Area	Corn harvested for grain[2]	Corn treated with -- Any herbicide	Atrazine	Atrazine + oil	Atrazine mixtures[3]	Percent treated with Atrazine
		-1,000 acres-				percent
Pennsylvania	1,036	872	536.3	18.3	253.8	78
Delaware	200	195	50.5		33.7	42
Maryland	500	436	218.0		127.7	69
Total	1,736	1,503	804.8	18.3	415.2	71
Virginia	461	405	248.3		71.7	69
Georgia	1,532	157	104.7			7
North Carolina	1,520	1,124	530.5		73.1	40
Kentucky	1,226	912	656.6		196.1	70
Total	4,739	2,598	1,540.1		340.9	40
Ohio	3,526	2,872	1,028.2	46.0	491.1	44
Indiana	5,509	4,445	2,098.0	62.2	782.3	53
Illinois	10,170	8,316	2,602.9	149.7	1,047.8	37
Iowa	11,570	7,947	2,860.9	468.9	1,049.0	38
Missouri	3,092	2,777	1,555.1		511.0	67
Total	33,867	26,357	10,145.1	726.8	3,881.2	44
Michigan	1,700	1,429	1,053.2	210.1	121.5	81
Wisconsin	2,099	1,930	1,520.8	210.4	223.9	93
Minnesota	5,725	4,670	1,471.1	481.0	228.8	38
Total	9,524	8,029	4,045.1	901.5	574.2	58
Colorado	406	157	53.7			13
South Dakota	2,679	1,266	340.6	24.1	24.1	15
Nebraska	5,356	3,065	1,578.5		628.3	41
Kansas	1,311	1,147	891.2		41.3	71
Total	9,752	5,635	2,864.0	24.1	693.7	37
ALL REGIONS	59,618	44,122	19,399.1	1,670.7	5,905.2	45

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[1] Unpublished data from "Pesticide Use--1971 Objective Corn Yield Survey," Farm Production Economics Division, ERS, USDA. The survey included only corn harvested for grain in 19 of the most important corn growing states. They accounted for 59.6 million acres out of a total of 63.8 million acres of corn harvested for grain. Herbicide usage on 10.2 million acres of corn harvested for silage is not included.

[2] Crop Production, 1971 Annual Summary, Statistical Reporting Service, U.S. Department of Agriculture, CrPr 2-1 (72), January 14, 1972.

[3] Atrazine mixed with another herbicide.

Dr. Merril Ross, Extension Botanist of the Purdue Botany and Plant Pathology Department, was contacted in regard to the residual effects of Atrazine. He indicates that if the recommended rate is applied, soybeans may be planted following corn with no damage. Also, his information indicates that this is commonly done in Indiana.

The recommended application rate varies by soil type and weed situation. Organic matter content is an important factor in determining rates for various types of soil. The recommended application rate in Indiana varies from two and one-half (80 wettable) to five pounds (80 wettable) which is the legal maximum. The most widely used rate is about three pounds.

Recommended rates for other states are very similar to Indiana, varying by soil type. For example, the northern half of Illinois has heavier soils (blacker, more organic matter) than most of Indiana and a lower rate is used. On the lighter soils of about two percent organic matter in Southern Illinois, approximately the same rate is used as in Indiana.

If the correct rate for the given soil type is used, there appears to be little danger of carryover effects. When more than the appropriate rate is used, definite damage may occur. Also, the manufacturer (Geigy) stresses that correct usage for given soil types present little danger.

There are other chemicals used for the same purpose as Atrazine, but their use is not widespread. Atrazine is by far the most important.

What to expect in the near future

The set-aside program has freed corn acreage to compete directly with soybeans. Since it appears that the shift of land from extensive to intensive

use has considerably diminished, corn and soybeans will necessarily compete for a relative fixed land base and other production resources. Therefore, any increase in soybean acreage will probably come at the expense of corn rather than coming primarily from other minor crops as has been the case in the past.

Because of the above-mentioned factors relating to the expected profitability and yield as well as problems associated with raising soybeans, it does not appear likely that soybean production will increase in the near future without added impetus provided by the feed grain program.

Soybean Production in the Delta States

Since 1960 soybean acreage in the Delta States (Arkansas, Mississippi and Louisiana) more than doubled. But since 1969 the acreage has leveled off. A number of factors may explain the recent level of soybean production and should be examined to gain insight into future changes.

Profile of Soybean Growers

Census data for 1969 show that only 38 percent of the farms in the three Delta states raised soybeans (table 9). But those on which soybeans were raised generally had a large acreage. For example, half of the soybeans were raised on farms with 500 acres or more of soybeans. Most of the soybeans were grown on either cash grain farms (65% of the soybean acreage) or on cotton farms (23%). From 1964 to 1969 about the same number of farmers grew soybeans, but the soybean acreage per farm increased about 60 percent. Cash grain farmers raising soybeans, for example, averaged over 300 acres of soybeans by 1969. The statistics also indicate that at least 40 percent of the soybeans are raised on farms where no cotton is grown. Thus soybeans do not compete directly with cotton on many farms in the Delta states--especially those farms outside of the Delta counties.

Soybean Yields. The average yield in the Mississippi Delta is 24 bushels per acre. Any increase in this yield is likely to come from improved management practices. Specifically, improved weed control could increase yields by as much as 25%. New chemicals for control of Johnsongrass and cockleburr are on the short-term horizon and make yield increases quite probable. In addition, these new chemicals offer to be relatively inexpensive, decreasing

Figure 6. Soybean acres planted in the Delta States and the Southeast States, 1960-1972.

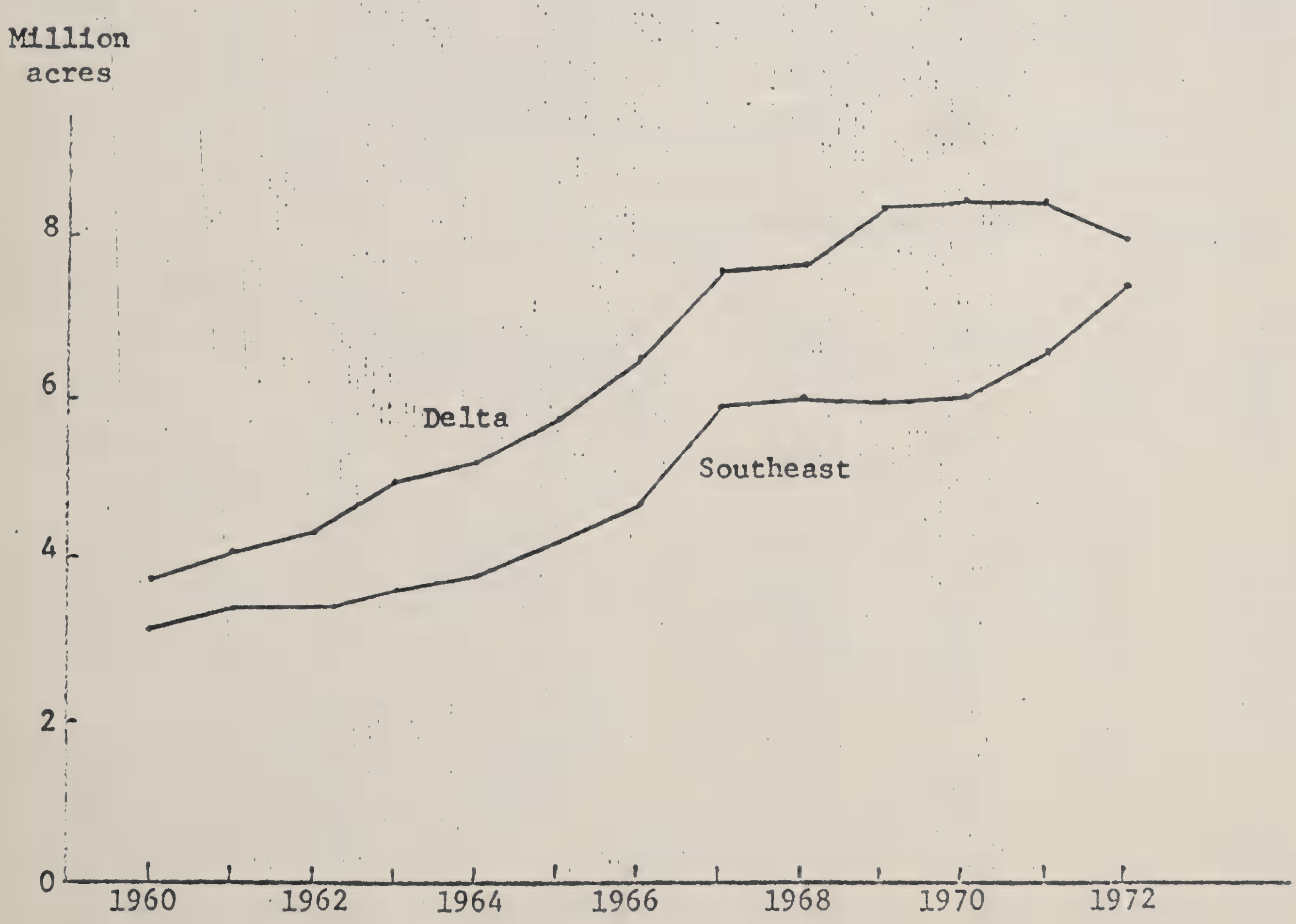

Table 9. Proportion of farms raising soybeans and distribution of soybean and cotton acreage by type of farm, Mississippi Delta States and Southeastern States, 1969.

Type of farm	No. of farms	Farms raising soybeans		Soybeans harvested			Cotton acreage
		Number	Percent	Total 1,000 acres	Percent of all soybeans	Acres per farm raising	1,000 acres
	Mississippi Delta States[1]						
Commercial farms[2]							
Cash grain	18,591	15,848	85	5,310	65	335	703
Cotton	12,845	8,620	67	1,886	23	219	1,508
General	5,553	3,149	57	540	7	171	257
Other	43,855	3,037	7	278	3	92	135
Total	80,844	30,654	38	8,014	98	261	2,603
Noncommercial	94,435	8,188	9	143	2	17	153
Total All Farms	175,279	38,842	22	8,157	100	210	2,756
	Southeastern States[1]						
Commercial farms[2]							
Cash grain	19,256	13,763	72	1,964	45	143	216
General	31,810	9,350	29	733	17	78	439
Tobacco	85,951	17,525	20	411	9	23	91
Livestock and ranches	90,590	8,586	9	386	9	45	165
Cotton	6,877	2,863	42	256	6	89	526
Other	90,073	7,943	9	326	8	41	208
Total	324,557	60,030	18	4,076	94	68	1,645
Noncommercial	344,085	20,884	6	265	6	13	190
Total All Farms	668,642	80,914	12	4,341	100	54	1,835

[1] Southeast States include: Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia and West Virginia.
Mississippi Delta States include: Mississippi, Louisiana and Arkansas.

[2] Economic Class I - V farms.

Source: U.S. Census of Agriculture.

production costs substantially from present levels where as much as $18 of the approximate $30 - $35 variable cost is for weed control.

No new, high yielding varieties appear eminent and current breeding work is emphasizing improvement of existing varieties. Improvements include development of varieties which are more disease resistant and herbicide tolerant. Breeders emphasize that currently available varieties are capable of much higher yields through improved management than presently being obtained.

Skip-Row Cotton Planting and Set-Aside. Cotton is planted in the skip-row pattern for two related reasons--one, to increase yields and secondly to meet set-aside requirements. ASCS estimated that in 1971 the distribution of the various skip-row patterns was:

2×1	81%
2×2	15%
Other	4%

One row skips are not eligible to be counted as set-aside and this pattern is for yield increase only. Even if any skip-row pattern were not allowed to count as set-aside, substantial skip-row acreage would still be planted.

It is difficult to estimate the increase in soybean acreage that might occur should soybean plantings on set-aside be allowed. Certainly some increase would be forthcoming. Weed control is a big factor as often fields of heavy infestations are designated set-aside and fallowed to alleviate the weed problem. Soybeans would not be grown on this acreage as yields would be low and the weed problem worsened. Also, land forming is often done on set-aside acreage and this prohibits soybean planting. On farms with relatively small domestic allotments, the set-aside acreage is consequently

small and unless significant acreage of soybeans is also grown on the farm, planting of soybeans on the set-aside would only be a nuisance.

Thus, while the aggregate set-aside acreage for the Delta is substantial, allowing soybean plantings on this acreage would likely result in some increase but the above mentioned factors would inhibit substantial increase.

Soil Categories and Distribution. A new soil mapping of the Delta was recently completed. From this survey, the soil types in the 11 Mississippi Delta counties were categorized and magnitudes determined (the Delta counties of Arkansas and Louisiana would be very similar). These 11 counties encompass 3.8 million acres and comprise the central soybean and cotton production regions. The general soils breakdown is as follows:

(a) clay, silty clay - 60%:	Predominately suited for soybeans,
(b) sandy loam, silty loam - 22%:	Predominately suited for cotton,
(c) silty clay loam - 12%:	Suited for either crop--"swing" soil.

While these soils will produce both cotton and soybeans, the categorization and utilization noted above is generally followed. With changing economic conditions, the "swing" soils are the first to be shifted from one use to another and these shifts are quite frequent. However, changes in relative profitability, etc. must be quite marked to precipitate changes in the utilization of the other two categories. For 1972, the favorable economic conditions for cotton prompted most of the "swing soils" to be planted to cotton.

Land Clearing. Very little land clearing in the Delta is presently being done and it is unlikely that any significant increase in soybean acreage will be forthcoming from newly cleared land. Much of the more productive, well-drained land has previously been cleared. Some remains, however, but the increase in clearing cost (now about $100/acre as opposed to $65-$75 previously), increased awareness of environmental factors, and uncertainty surrounding future soybean prices deter additional clearing.

Other Crop Alternatives. Soybeans are the next best alternative to cotton in the Delta and in many cases the only alternative. Continual experimentation and search for other alternatives is underway. Vegetables, sunflowers, corn for silage, peanuts, etc. are included in crops that are or have been tried. Utilization of corn for high-energy silage to be fed at on-farm finishing feedlots is gaining in popularity and is described as a good alternative to cotton should programs be drastically altered or cotton's competitive position be severely worsened. Several feedlot operators have reported costs of gain (from 500 to 1000 lbs.) around 8¢/lb. which makes corn quite competitive.

Another promising alternative is a new variety of wheat (Coker). The average yield for Delta counties is about 30 bushels per acre and as much as 45 can be expected. A favorable price is $1.10 per bushel. This could be doublecropped with soybeans and should it increase significantly in acreage, it would cause many soybeans to be planted late--as late as July 15. Soybeans planted this late yield much less (soybean yield behind wheat is about 18 bushels). While soybeans yield substantially less, they are "cheap"

soybeans in that production costs are small. They require only small amounts of herbicide and little cultivation giving variable production costs of around $10 per acre. Thus, should this new wheat variety be adopted extensively, the ramifications for soybean production could be significant.

Doublecropping presently is not of great importance (widespread) in this area. Of the wheat grown, it has been estimated that only about 35% is followed by soybeans. The remainder is either fallowed or formed. With machinery costs increasing, however, more attention is being given to spreading harvesting equipment overhead through doublecropping.

<u>1973 Cotton Outlook and Program Changes</u>. Cotton acreage in the U.S. increased 1.7 million acres in 1972 over the previous year. The Delta States accounted for 0.8 million of this increase. Even with the increased acreage, the total production could only be slightly above that of 1972. Average yields have decreased in the past few years in this area. Presently, the yield is not expected to be much different than that of the 1971 crop.

If farmers' expected cotton price is in the 25-28 cent range and the expected soybean price is about $2.90 per bushel, then little change from the present acreage allocation is expected for 1973. However, a strong variable in this decision is weather at planting time. Should early planting weather be severely unfavorable, a substantial increase in soybean acreage could occur. The majority of the cotton crop is normally planted during the period May 5-June 25, while soybeans are planted from May 1-July 15.

Soybean Production in the Southeast[6]

Soybean acreage in the Southeast rapidly expanded until 1967, leveled off for three years, and then expanded again in 1971 and 1972. Relative to the Delta States, there are many more farms growing soybeans in the Southeast, but the acreage grown per farm is much smaller. Census data for 1969 show twice as many farmers raising soybeans in the Southeast as in the Delta, but the total soybean acreage in the Southeast is smaller (table 9). Even though there are many small plots of soybeans, there is also a significant number of large soybean farmers in the Southeast. Table 4 shows that in Tennessee and South Carolina 25% and 20%, respectively, of the soybeans were grown on farms raising 500 or more acres in 1969.

Soybeans compete primarily with corn, cotton and set-aside for rowcrop land, but any major expansion in soybean acreage in the next decade will have to come at the expense of corn. In 1972, farmers in the region planted 7.2 million acres of corn, 7.0 million acres of soybeans and less than 2 million acres of cotton. About 4 million acres were set-aside in the feed grain and cotton programs. Compared with the Delta States, there is less direct competition between soybeans and cotton. On many farms with substantial soybean acres, little or no cotton is grown. On the other hand, cotton farms raise only six percent of the soybeans (table 9).

Other factors affecting soybean production in the Southeast are:

(a) Weed problems have recently become more severe.

(b) Storage shortages cause relatively low prices during the harvest period in localized areas.

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[6] The Southeast consists of nine states from Virginia to Florida to Alabama to Kentucky.

(c) Diseases, nematodes and other disease problems are on the increase possibly because more farmers are growing soybeans after soybeans or in small grain stubble.

(d) Double-cropping soybeans after small grain is possible.

(e) Risk of corn relative to soybeans is greater in some areas corn is more risky to grow than soybeans and corn requires more monetary inputs. Soybeans are more drought tolerant than corn, and

(f) Expansion of livestock, in the longer-run, will hold down the expansion of soybean acres as farmers grow more feed.

Outlook for 1973 - No Change in Farm Programs

If there are no changes in the feed grain and cotton programs in 1973, it appears that there will be little change in soybean acreage planted. Analysts in the South indicate that under price conditions favorable to cotton ($2.65 soybeans and $0.29 cotton), about 15 million acres of soybeans would be planted in the South. With more favorable soybean prices ($3.00 soybeans and $0.25 cotton), 15.9 million acres would be planted--a half million acre increase over 1972.

Because of high corn prices, analysts in the Midwest expect soybean acreage to decrease slightly. Thus the net effect over all the soybean-producing regions would likely be no change.

In the remainder of the paper changes in the feed grain program and the resulting impact on corn and soybean production will be examined.

No changes in the cotton program are examined in detail. The only possible changes in the cotton program that seem likely to increase soybean acreage are to allow soybeans to be grown on cotton set-aside or reduce cotton set-aside. But these changes probably would not significantly increase soybean acreage because some of the land now in set-aside is too weedy for soybeans, being formed, or in 2×2 skip-row cotton.

Evaluation of Alternative Feed Grain Programs for 1973

In this report, three alternative feed grain programs are evaluated to determine their potential for inducing the above production in 1973. In general, the analysis concentrates on ways to increase soybean acreage, slightly reduce corn acreage and reduce set-aside acreage. Other ground rules are (a) the 1972 loan rates for feed grains and soybeans cannot be changed, and (b) direct acreage limitations, based on bases or allotments, cannot be used.

All the feed grain program alternatives examined utilize a type of "alternative B" approach where the emphasis is on inducing farmers, via the feed grain program, to shift land from corn or set-aside to soybeans.

The analysis concentrates on the North Central Region where the interaction among corn, soybeans and set-aside is most important. An examination of the 1972 signup in the feed grain program shows that most of the impact on soybeans, due to alternative B, came from the North Central Region (see table 10). In the South Central the additional alternative B acreage was in Texas and Oklahoma, not in the soybean areas. The Southeast and Plains combined may have experienced at most a 0.5 million acre increase in soybeans due to alternative B. Thus to reach the 1973 acreage target with an alternative B type of program, most (about 3.5 million acres) of the 4.2 million acre increase in soybeans will have to come from the North Central Region.

Table 10. Voluntary set-aside acres under alternative B of the feed grain program compared with planted soybean acres, by regions of the U.S., 1972.

Region	Acres soybeans planted 1972	Voluntary set-aside acres, Alternative B[1/]	
		Corn	Grain sorghum
	(000)	(000)	(000)
North Central	28,315	2,137	32
South Central	8,382	24	169
Southeast	7,023	265	3
Plains	2,163	480	140
Other	540	48	22
Total	46,423	2,954	366

[1/] Enrolled.

Previously, the greatest increase in the region was 2.5 million acres from 1971 to 1972. The July 1972 crop report indicates that about 28.3 million acres of soybeans were planted in the North Central Region in 1972. Thus, it was assumed that 31.8 million acres of soybeans would need to be grown in the North Central Region in 1973 to have 50.6 million acres nationally.

Alternative feed grain programs

The three feed grain programs examined are:

(a) The 1972 feed grain program--no changes for 1973.

(b) The "25%-revised" program: In this program alternative A is the same as in 1972 except additional set-aside of up to 25% of the corn, grain sorghum, or barley base is allowed. Alternative B permits set-aside beyond the required 25% minimum of up to an additional 25% of the corn and grain sorghum base. The participant must raise soybeans on the additional set-aside acres and his 1973 corn and grain sorghum acreage plus additional set-aside acreage (on which soybeans are planted) cannot exceed his 1971 corn and grain sorghum acreage. Payment rates per acre for mandatory set-aside are the same as in 1972. On the acres shifted from corn or sorghum to soybeans (the voluntary alternative B set-aside acres), the payment is reduced. In this analysis a payment rate of 14¢ and 20¢ per bushel established yield for corn was used.

(c) The "20%-revised" program: In this program there also is an A and B alternative. Under both alternatives a mandatory 20% of the feed grain base must be set-aside (except for barley, 25%), but an additional voluntary set-aside of up to 35% of the corn and grain sorghum base is allowed. As in (b) above, under alternative B the voluntary set-aside acres can be planted to soybeans but the set-aside payment is reduced.

The provisions of these three programs are summarized in table 11.

Evaluation of Alternatives--North Central Region

The three alternative feed grain programs are evaluated under the assumptions that (1) 31.8 million acres of soybeans will be planted in 1973 in the North Central Region, and (2) the only means of adjusting corn, soybean and set-aside

Table 11. Summary of the provisions of the three alternative feed grain programs analyzed for 1973.

Item	Unit	1973 Feed Grain Program Alternatives: '72 Program	25%-Revised	20%-Revised
Alternative A:				
Set-aside required (minimum)	percent	25	25	20[1]
Additional voluntary set-aside (maximum)	percent	30	25	35
Payment (corn) per bu. established yield on set-aside acres - required S.A.	dollar	0.80	0.80	0.80
- voluntary S.A.	dollar	0.52	0.52	0.60
Alternative B:				
Set-aside required (minimum)	percent	25	25	20[1]
Additional voluntary set-aside (maximum)	percent	15	25	35
Payment (corn) per bu. established yield on set-aside acres - required S.A.	dollar	0.80	0.80	0.80
- voluntary S.A.	dollar	0.80	.14 and .20	0.20
Special provisions		Note A	Note B	Note B

Note A: Corn (grain sorghum) acreage in 1973 must be reduced below 1971 acreage by two acres for each acre of voluntary set-aside in 1973.

Note B: Corn (grain sorghum) acreage plus voluntary set-aside acreage in 1973 cannot exceed 1971 corn (grain sorghum) acreage. Soybeans may be raised on voluntary set-aside acres.

[1] A minimum of 25% of the barley base must be set-aside.

acreages is by changing the rate of participation in the various alternatives available in the feed grain program. The latter assumption implies that farmers' relative profit expectations for the 1973 crop of corn and soybeans do not differ from their 1972 profit expectations.

The alternatives, compared with actual 1972 data, are shown in table 12.

Table12. Summary of results, three alternative feed grain programs, North Central Region, 1973. (This table shows the sign up conditions that would have to exist in order to have 31,800,000 acres of soybeans planted, under each of the three programs.)

			1973 alternatives		
	Unit	Actual 1972	'72 Program	25%-Revised	20%-Revised
Soybeans planted	1,000 acres	28,315	31,800	31,800	31,800
Corn planted	"	42,485	37,600	40,900	41,300
Corn set-aside	"	14,630	16,000	12,300	11,700
Corn base:					
Nonparticipating	"	7,600[1]	7,600	7,600	7,600
Alternative A	"	26,600[1]	4,800	15,500	22,500
Alternative B	"	17,200[1]	39,000	28,300	21,300
TOTAL	"	51,400[1]	51,400	51,400	51,400
Cost of Program[2]	million dollars	$ 1,000[1]	$1,200	$ 950-980	$ 910

[1] Enrolled data.

[2] Corn only.

Several conclusions can be drawn from the analysis:

1. It will be very difficult to reach the 1973 soybean acreage goal using the 1972 feed grain program with increased signup under alternative B. It is unreasonable to expect 39 million acres to be signed up under alternative B in the

North Central Region. That is 76% of the region's corn base. In 1971, for example, only 54% of the participant farms raised soybeans. A major reduction in corn acreage and a 1.4 million increase in set-aside acreage would accompany such a major signup under alternative B. Corn acreage would be cut too much and set-aside would be too high.

2. The complete elimination of alternative A and expanded signup in alternative B in 1973 would give similar results to those shown under "72 program" in table 12. The result would be that if soybean acreage were increased substantially, corn acreage would be too low and set-aside acreage would be too high. However, the most likely result would be that corn acreage would be about right and soybean acreage would be too low.
3. A plan that appears somewhat more feasible is the "25%-Revised" alternative B for 1973. In the North Central Region, 28.3 million acres of corn base (55% of total corn base) would be needed in alternative B to reach the soybean production target. The corn-soybeans-set-aside acreage relationships are more in balance. But to obtain the 28.3 million acres of corn base under alternative B, nearly every farmer that raised soybeans in recent years would need to sign up under alternative B. Thus the "25%-Revised" program, though more realistic in balancing corn-soybeans-set-aside acreage than the 1972 program, still would probably not succeed in inducing 31.8 million acres of soybeans in the North Central States.
4. The "20%-Revised" feed grain program appears to hold the most promise of the three 1973 alternatives, of achieving a desirable balance among corn acres, soybean acres and set-aside acres. The balance is achieved at a more realistic

signup in alternative B and a lower government cost. The key feature of this alternative is that it reduces mandatory set-aside and allows those farmers who wish to switch from corn to soybeans to receive an incentive payment for a larger acreage (equivalent to 35% of their corn base).

National Results: "20%-Revised" Feed Grain Program

Because of the initial results obtained from the 20%-Revised feed grain program in the North Central Region, a national analysis was made. The Aggregate Production Analysis Team (APAT), FPED, ERS, estimated production of all major crops in 1973 using the 20%-Revised feed grain program. Other assumptions made are listed in footnote 1 to table 13. Detailed results and assumptions are given in Appendix tables 1 and 2.

Summarized results, in table 13, show corn production of almost 5 billion bushels and soybean production slightly over 1.4 billion bushels. Total set-aside acreage in 1973 is higher than in 1972 by 6.2 million acres, but the 1973 figure includes 6.8 million acres on which soybeans or other nonrestricted crops are grown. Wheat set-aside is estimated to be up 2.8 million acres over 1972.

Summary

With inducements provided by the feed grain program, it appears feasible to obtain 1.4 billion bushels of soybeans in 1973 and still hold corn production to 5 billion bushels. The "20%-Revised" feed grain program, as described above, would give farmers who wanted to raise soybeans the incentive to switch some acres to soybeans from corn or grain sorghum, it would

Table 13. Estimates of crop production and set-aside acreage in 1973 compared with 1971 and 1972, U.S.[1]

Item	Unit	1971	1972[2]	Projected 1973
Corn	million bu.	5,540	5,124	4,994
Grain sorghum	million bu.	895	854	938
All feed grains	million tons	205	189	190
Soybeans	million bu.	1,169	1,286	1,422
All wheat	million bu.	1,640	1,560	1,554
Cotton, upland	million bales	10.5	13.5	12.0
Set-Aside				
Feed grain	million acres	18.2	37.4	40.7[3]
Wheat	million acres	13.5	20.4	23.2
Cotton	million acres	2.1	2.0	2.1
Total	million acres	33.8	59.8	66.0[3]

[1] The 1973 estimates are based upon the "20%-Revised" feed grain program, the 1973 wheat program as announced, and the cotton program essentially unchanged from 1972. Farmers' expected prices were assumed to be (nationally) $1.15 - corn; $1.10 - sorghum; $0.95 - barley; $0.59 - oats; $1.38 - wheat; $2.95 - soybeans; $0.25 - cotton lint and $57.00 - cotton seed. The wheat certificate value was $1.78 per bushel.

[2] September 1 estimates.

[3] Includes 6.8 million acres of set-aside under Alternative B that can be planted to unrestricted crops such as soybeans.

lower the mandatory or minimum set-aside requirement, and it would allow farmers who had no profitable alternative to corn or grain sorghum to set-aside extra land under alternative A. It is, however, a program as complicated as in 1972.

Another approach--one which was not evaluated in detail--would be to use the "20%-Revised" program without alternative A. The main drawback of this approach is that total set-aside acreage would be substantially reduced and a corn crop of the 1971 magnitude might result. For example, the APAT results for 1973 had 7 million acres of voluntary set-aside under alternative A for corn, and 3 million acres for grain sorghum. If no alternative A were offered, most of this acreage would go into feed grain production.

APPENDIX

Table 1.--APAT estimates of major crop acreages and production for alternative set-aside program provisions, U. S. - 1973

Item	Unit	1971	1972 Estimates 1/	1973 Crop Year
				Alternative 2
Corn:				
planted	mil. ac.	74.1	66.8	65.3
harvested	mil. ac.	63.8	57.1	56.8
production	mil. bu.	5,540.3	5,124.4	4,994.1
yield	bu./ac.	86.8	89.7	88.0
Grain Sorghum:				
planted	mil. ac.	21.3	17.4	18.0
harvested	mil. ac.	16.6	14.0	15.3
production	mil. bu.	895.3	854.3	938.0
yield	bu./ac.	53.9	61.1	61.2
Barley:				
planted	mil. ac.	11.1	10.6	9.8
harvested	mil. ac.	10.1	9.6	8.9
production	mil. bu.	462.5	418.2	397.6
yield	bu./ac.	45.6	43.4	44.8
Oats:				
planted	mil. ac.	22.0	20.5	19.8
production	mil. bu.	875.8	730.8	890.2
All Feed Grains:				
planted	mil. ac.	128.4	115.3	113.0
harvested	mil. ac.	106.3	94.9	97.7
production	mil. tons	205.3	189.1	189.9
yield	tons/ac.	1.93	1.99	1.94
Soybeans:				
planted	mil. ac.	43.1	46.4	50.2
harvested	mil. ac.	42.4	45.8	49.2
production	mil. bu.	1,169.4	1,286.0	1,421.6
yield	bu./ac.	27.6	28.1	28.9
Winter wheat, planted	mil. ac.	38.7	42.6	39.5
Spring wheat, planted	mil. ac.	13.1	10.3	10.5
Durum wheat, planted	mil. ac.	2.8	2.6	2.6
Total Wheat:				
planted	mil. ac.	54.6	55.5	52.6
harvested	mil. ac.	48.5	47.8	47.4
production	mil. bu.	1,639.5	1,559.5	1,554.1
yield	bu./ac.	33.8	32.6	32.8
Rye:				
planted	mil. ac.	5.0	--	2.4
production	mil. bu.	50.9	31.3	26.1
Upland Cotton:				
planted	mil. ac.	12.4	13.8	13.0
harvested	mil. ac.	11.5	13.1	12.2
production	mil. bales	10.5	13.5	12.0
yield	lbs/ac.	442	495	475

able 1.--APAT estimates of major crop acreages and production for alternative set-aside program provisions, U. S. - 1973 -- Cont'd

Item	Unit	1971	1972 Estimates 1/	1973 Crop Year
				Alternative 2
eed Grain Set-Aside:				
required	mil. ac.	18.2	27.0	21.5
voluntary	mil. ac.	0	10.4	19.2 2/
Total	mil. ac.	18.2	37.4	40.7
heat Set-Aside:				
required	mil. ac.	13.5	15.3	15.6
voluntary	mil. ac.	0	5.1	7.6
Total	mil. ac.	13.5	20.4	23.2
otton Set-Aside:				
required	mil. ac.	2.1	2.0	2.1
ll set-aside	mil. ac.	33.8	59.8	66.0 3/

1/ Planted acreages from July 1, 1972, Crop Report. Harvested acreages, production and arvested acre yield from September 1, 1972 Crop Report. Set-aside estimates from June 8, 972 ASCS final enrollment report.

2/ Voluntary set-aside from feed grains include 6.8 million acres of set-aside under ption B which can be planted to unrestricted crops such as soybeans. (See Table 2.-- rogram assumptions underlying APAT analysis of 1973 set-aside program, for an explanation f Option B of the feed grain program.)

3/ A total of set-aside acreage and land used for crops will overstate land use since he acreage of feed grain set-aside that is planted to soybeans or other unrestricted rops will be double counted.

Table 2.--Program assumptions underlying APAT analysis of 1973 Set-Aside Program

Item	1973 Crop Year	
	Alternative 2	
Substitution: (Wheat & feed grains)		
Feed grains & wheat	Yes	
Soybeans	Yes	
Barley in program	Yes	
Loan rates:		
Corn ($/bu.)	1.05	
Sorghum ($/cwt.)	1.79	
Barley ($/bu.)	0.86	
Wheat ($/bu.)	1.25	
Soybeans ($/bu.)	2.25	
Cotton ($/lb.)	0.195	
Set-aside, required (%):	1/	
Feed grain program	20	
Wheat program	86	
Cotton program	20	
Payment rate, required set-aside:		
Corn ($/bu.)	0.32	
Sorghum ($/bu.)	0.29	
Barley ($/bu.)	0.32	
Wheat ($/bu.)	1.78 2/	
Cotton, upland ($/lb.)	0.15	
Set-aside, additional (%):		
Option	A	B
Feed grain program program 3/	35 4/	35
Acreage ceiling (corn & sorghum)	No	Yes 5/
Use of land taken out of feed grains	Set-aside	Unrestricted crops
Wheat program	150	
Acreage ceiling 6/	Yes	
Cotton program	0	
Payment rate additional set-aside:		
Option	A	B
Corn ($/bu.)	0.60	0.20
Sorghum ($/bu.)	0.56	0.18
Barley ($/bu.)	0.48	N.A.
Wheat ($/bu.)	0.88	
Cotton, upland (¢/lb.)	0	
Farmers expected prices:		
Corn ($/bu.)	1.15	
Sorghum ($/bu.)	1.10	
Barley ($/bu.)	0.95	
Oats ($/bu.)	0.59	
Wheat ($/bu.)	1.38	
Soybeans ($/bu.)	2.95	
Cotton lint ($/cwt.)	0.25	
Cotton seed ($/ton)	57.00	
Set-aside target (mil. ac.):		
Feed grain program	None	
Wheat program-required	15.0	
voluntary	None	
Cotton program	None	

Footnotes begin on next page.

Footnotes

1/ Required set aside for barley is 25 percent as officially announced in the 1973 wheat program.

2/ Difference between estimated parity price of wheat on July 1, 1973 and the wheat loan level. Actual payments may be smaller if market price in the first 5 months of the marketing year is above the loan level.

3/ An upper limit. The Secretary could retain the option of either accepting or rejecting the last 10 percent of voluntary set-aside offered prior to the planting season.

4/ Maximum voluntary set aside for barley is 30 percent. Maximum total set aside is equal to 55 percent of the base for all feed grains.

5/ For participating farms the acreage of corn and sorghum in 1973 plus the acreage of voluntary reduction under this option cannot exceed 1971 corn and sorghum acreage.

6/ For participating farms the total acreage of wheat planted plus acreage voluntarily set-aside under this option for 1973 cannot exceed the 1972 total of wheat plus voluntary wheat set-aside. Under the announced provisions for 1973 the 1972 program acreages are those reported and accepted for compliance.

APAT/FPED/ERS/Sept. 13, 1972